

1987-220

## LAKE LANDFILL

## EMISSIONS ANALYSIS FROM FLARE COMBUSTION

A. INLET CONDITIONS

## Gas Concentration:

Methane	60%
Carbon Dioxide	40%
Non-methane Hydrocarbons	203 ppm
Sulfur Compounds	47 ppm

## Gas Flow

4x10<sup>6</sup> CFD

EPA Region 5 Records Ctr.

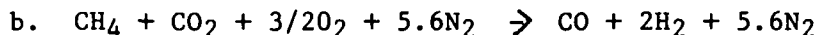
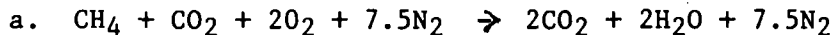


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B. EMISSIONS CALCULATIONS

## Assumptions:

1. Methane combustion efficiency of 99.8 minimum is assumed.\*
2. 95% combustion efficiency is assumed for trace hydrocarbons.
3. Unburned methane is assumed to produce carbon monoxide.
4. Balanced equations for 1 & 2 above are:



## Mass Calculation: (#/day)

Mass calculations were determined using the following equation:

$$\#/\text{day} = (\text{inlet concentration}) \times (\text{gas density}) \times (\text{flow})$$

Gas densities are at 60°F and 760 millimeters Hg pressure.

Gas concentrations are based on typical landfill gas analysis.

Flow is based on maximum capacity at the flare station of 4.0x10<sup>6</sup> cfd.

Component:/Mass Calculation

$$\text{CH}_4: (.60) (.0423\#/\text{CF}) (4 \times 10^6 \text{CFD}) = 1.01 \times 10^5 \#/\text{day}$$

$$\text{CO}_2: (.40) (.1140\#/\text{CF}) (4 \times 10^6 \text{CFD}) = 1.82 \times 10^5 \#/\text{day}$$

$$\text{Sulfur}: (4.7 \times 10^{-5}) (.20\#/\text{CF}) (4 \times 10^6 \text{CFD}) = 37.6 \#/\text{day}$$

$$\text{Hydrocarbons}: (2.10^{-4}) (.2271\#/\text{CF}) (4 \times 10^6 \text{CFD}) = 181.6 \#/\text{day}$$

Combustion Analysis

$$\begin{aligned} \text{CO}_2: \frac{(.9983) (1.01 \times 10^5 \#/\text{d CH}_4)}{16 (\text{mol wt. of CH}_4)} &= \frac{2\text{CO}_2 \#/\text{d}}{44 (\text{mol wt. of CO}_2)} \\ &= 1.39 \times 10^5 \#/\text{day CO}_2 \end{aligned}$$

$$\begin{aligned} \text{H}_2\text{O}: \frac{(.99) (1.01 \times 10^5 \#/\text{d CH}_4)}{16 (\text{mol wt. of CH}_4)} &= \frac{2\text{H}_2\text{O} \#/\text{d}}{18 (\text{mol wt. of H}_2\text{O})} \\ &= 5.62 \times 10^4 \#/\text{day H}_2\text{O} \end{aligned}$$

\* Based on a report prepared for the Chemical Manufacturers Association and USEPA entitled: "A Report On A Flare Efficiency Study, March, 1983."

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$$\text{CO: } \frac{(.0017) (1.01 \times 10^5 \#/\text{d CH}_4)}{16 (\text{mol wt. of CH}_4)} = \frac{\text{CO\#/d}}{28 (\text{mol wt. of CO})}$$

$$= 3 \times 10^2 \# \text{CO/day}$$

$$\text{SO}_2: \frac{37.6 \#/\text{day Sulfur}}{50 (\text{avg. mol wt.})} = \frac{\text{SO}_2/\text{day}}{64 (\text{mol wt. SO}_2)}$$

$$(\text{of Sulfur cmpds}) = 48 \#/\text{day SO}_2$$

$$\text{Hydrocarbons: } (.05) (181.6 \#/\text{d}) = 9.1 \#/\text{day}$$

$$\text{CH}_4: (.0017) (1.01 \times 10^5 \#/\text{day}) = 171.7 \#/\text{day}$$

### C. EMISSIONS SUMMARY

<u>Component</u>	<u>#/Day</u>	<u>Tons/Year</u>
CO <sub>2</sub>	1.39x10 <sup>5</sup>	25,367
CO	3x10 <sup>2</sup>	54.75
H <sub>2</sub> O	5.62x10 <sup>4</sup>	10,256
SO <sub>2</sub>	48	8.7
HC	9.1	1.66
Methane	171.7	31.33